Inspira Decora: AI-Powered Interior Redesigning Solutions

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***Abstract*— By facilitating automation, personalisation, and quick visualisation, artificial intelligence (AI) is progressively changing the creative industries. However, interior design is still mostly dependent on manual procedures, professional consultations, and lengthy iterations, which makes it expensive and unavailable to many consumers. Current digital design tools frequently offer static templates with little flexibility to accommodate user preferences and real-world settings.**

Inspira Decora, an AI-powered interior redesigning platform, is presented in this article. Users can create customized interior designs by just uploading pictures of their spaces and choosing their favourite styles. In order to analyse spatial information and provide photorealistic redesign outputs that meet user criteria, the system makes use of generative AI models. Using contemporary frameworks, a full-stack web architecture is implemented to guarantee scalability, responsiveness, and usability.

Secure user identification, cloud-based picture storage, credit-based service access, and an easy-to-use dashboard for managing design projects are some of the platform's key features. Inspira Decora speeds up the design decision-making process and lessens reliance on professional designers by combining AI-driven image production with a user-centric interface.
A key feature of the platform is local deployment, which ensures cost- effectiveness, and independence from cloud services. A detailed literature review highlights major limitations in current AI marketplaces, such as limited customization, high infrastructure costs, reliance on generic models, and lack of support for non- technical users. By integrating automated data generation, parameter-efficient fine-tuning, and an intuitive interface, the proposed system enables both technical and non-technical users to build and deploy task- specific assistants easily.

By offering quick, inexpensive, and aesthetically pleasing redesign ideas, the suggested method shows how AI may democratise interior design. Improved usability, effective performance, and great satisfaction in creating personalised interior designs are demonstrated by experimental findings and user comments, making Inspira Decora a useful option for both homeowners and design experts.

***Keywords*— Artificial Intelligence, Generative AI, Full-Stack Web Applications, Image-Based Interior Design, Automated Interior Redesign, User-Centric Design, and Cloud-Based AI Systems.**

I. INTRODUCTION

BACKGROUND

By facilitating automation, intelligent decision-making, and customized user experiences, artificial intelligence (AI) has become a potent technology that is revolutionizing a number of industries [1]. AI has received a lot of attention lately in creative industries like interior design and architecture, where customisation and visualisation are crucial [2]. Systems may analyse visual inputs and produce realistic design outputs using generative AI models and image-based processing approaches, which lessens reliance on manual design procedures.

Interior redesign is still primarily a manual, expert-driven process despite these developments. Conventional design processes necessitate expert consultations, numerous iterations, and a substantial time and financial commitment [3]. Current computer tools for interior design frequently rely on static templates or constrained style options, which are unable to completely accommodate the distinct spatial features of actual rooms [4]. Because of this, people find it difficult to envision customized interior designs that fit their tastes and available space. Using models for picture production and transformation, several AI-powered design platforms try to tackle these issues [5].

Nevertheless, a lot of these systems lack useful deployment features including scalable architecture, design history management, secure user authentication, and revenue streams. Furthermore,

these systems' complexity makes them difficult for non-technical individuals to operate, which lowers their uptake in practical situations.

An intelligent, user-friendly, and scalable AI-based solution is required to get beyond these restrictions and allow users to effectively create customised interior redesigns while preserving performance and accessibility.

Objectives

The main goal of this effort is to create an AI-powered platform for interior redesign that streamlines the design process and increases end users' accessibility. The following are the precise goals of the suggested system:

1. To create a user-friendly platform that makes it possible to change an interior with just a few image uploads and style choices.
2. To incorporate generative AI models to create customised and realistic interior design results.
3. To offer safe account management and user identification for design history storage.
4. To put in place cloud–based storage for effective management of uploaded photos and created designs.
5. To create a scalable full-stack online application that guarantees dependability, responsiveness and usability.

II. LITERATURE SURVEY

In order to automate visualisation and minimise manual labour, artificial intelligence is being used more and more in interior design. Early AI-assisted interior design systems mostly relied on template-driven recommendations and rule-based layout development, which restricted customisation and flexibility. Generative methods have made design synthesis more adaptable and realistic with the advent of deep learning. AI-based methods can greatly speed up interior renovation while enhancing visual quality and user engagement, according to recent studies [1].Because of their stability and capacity to generate high- resolution, photorealistic results, diffusion-based generative models have become a popular method for interior picture synthesis. Diffusion models may produce a variety of interior design images from textual prompts while maintaining stylistic consistency among outputs, as Chen et al. showed [1]. Their work does not address user interaction procedures or deployment considerations, but it does demonstrate how successful diffusion models are for visual ideation.The application of fine-tuning techniques to generative models has addressed personalisation. DreamBooth is a technique developed by Gal et al. that enables diffusion models to generate customised images by learning user-specific concepts from a limited amount of images [2]. Because it enables outputs to closely match user preferences, this kind of personalisation is beneficial for interior remodelling. Nevertheless, the method is computationally orientated and lacks scalable application deployment, multi-user access, and design history management capabilities.In interior design, practical layout and spatial organisation are just as important as visual authenticity. A conditional room layout generating framework based on graph neural networks that simulate the connections between furniture pieces and room geometry was presented by Yao et al. [3]. This method guarantees realistic interior element placement and functional coherence. However, the produced outcomes are restricted to abstract arrangements and lack photorealistic visualisation, which diminishes end users' usability.For the creation of interior and architectural layouts, generative adversarial networks (GANs) have also been investigated. To create interior layouts while maintaining circulation routes and zoning restrictions, Wang et al. created a GAN-based approach [4]. Compared to diffusion-based methods, GANs frequently experience training instability and have less control over fine- grained visual features, despite their capacity to capture spatial patterns [1], [4].

Recent studies try to combine generative design models with aesthetic assessment. In order to increase output quality and generation efficiency, Chen et al. suggested an AI-driven interior design system that blends diffusion-based image production with aesthetic assessment [5]. The system is still a prototype and lacks capabilities like user identification, permanent storage, and real-world deployment pipelines, despite its enhanced visual appeal and quicker iteration.The majority of AI-based interior design solutions, according to several evaluation studies, concentrate on discrete tasks like picture production, layout planning, or style transfer rather than providing whole end-to-end systems [6]. These studies draw attention to issues

with data privacy, scalability, usability, and integration with contemporary digital platforms. They contend that full-stack deployment techniques, user-centric interfaces, and generative AI models must be combined for practical adoption.It is clear from the literature that layout-aware models increase functional feasibility [3], [4], personalisation strategies promote user alignment [2], and diffusion models excel at visual realism [1]. Nevertheless, there are currently no unified platforms that combine these features with cloud-based storage, scalable online deployment, and secure user administration. This research gap drives the creation of Inspira Decora, a full-stack, AI-powered interior designing platform that seeks to close the gap between model-level innovation and practical use.

III. METHODOLOGY

A. Requirement Analysis

Designing an AI-powered interior redesign platform that is scalable, effective, and accessible for real-world users is the main objective of the suggested system. Users must be able to upload room photos, specify their preferences for interior design, and quickly receive realistic redesigned outputs from the system. Ease of use, compatibility with various design styles, safe user authentication, and effective image data processing are important requirements [1]. Performance requirements prioritise device compatibility, quick response times, and trustworthy AI inference.

B. System Design

The system has a modular full-stack architecture for scalability and maintainability. The frontend was developed using modern web frameworks to offer a responsive and user-friendly experience for uploading photographs, selecting styles, and visualising outcomes. The backend manages request processing, database operations, AI model interaction, and authentication. Cloud-based storage is used to securely store user-uploaded images and generated redesign outputs. This layered architecture allows for the separation of concerns and makes it easier to develop AI models and features in the future [6].

C. Compiling and Preparing Information

The primary input for the system is user-uploaded images of rooms. The format and size of these photos are checked before processing. Preprocessing techniques include scaling, normalisation, and augmentation to ensure interoperability with generative AI models. To guide the redesign process, the image input is paired with metadata, such as the kind of room and the selected design style. Appropriate preprocessing improves model performance and consistency of results [3].

D. AI-Powered Interior Design Development

The system's main features are powered by generative AI models that can transform room photos into rebuilt interiors. Diffusion-based models are used because they maintain structural consistency while producing high-quality, photorealistic images [1]. The use of user-selected styles as conditioning inputs during creation enables personalised redesign outputs. The system focusses on image-based transformation instead of layout reconstruction to ensure faster inference and enhanced visual realism [5].

E. User management and security

Secure user authentication is used to manage individual accounts and protect user data. Design history, generated outputs, and submitted photos are all tracked during each user session. Role-based access control ensures that specific features are only accessible by authorised users. Encrypted storage systems and secure communication techniques are used to protect sensitive data and private information [6].

F. Integration and Deployment

AI services, storage, frontend, and backend are all smoothly combined into one platform. The system's deployment makes advantage of cloud infrastructure to facilitate scalability and availability. AI inference services are designed to efficiently handle multiple queries without degrading performance. Staged deployment and local testing are used to guarantee system reliability before public access [4].

G. Testing and Validation

The system undergoes unit, integration, and system testing to guarantee accuracy and dependability. The visual quality, responsiveness, and conformity to user preferences of AI- generated outputs are evaluated. User feedback is collected to assess usability and satisfaction. These validation processes enable the platform to meet both functional and non-functional requirements [2].

H. Upcoming Improvements

Future improvements like redesigning many rooms, supporting different design styles, and including 3D or augmented reality features are all made possible by the architecture. Additional enhancements could involve optimising AI inference for quicker performance and improving personalisation through adaptive learning [6].

IV. ALGORITHM

A. AI-POWERED INTERIOR REDESIGN GENERATION ALGORITHM

This algorithm automates the transformation of user-uploaded room images into professionally redesigned interiors using generative AI models. It leverages Replicate's image-to-image AI capabilities, integrated within a full-stack Next.js application, to produce photorealistic redesigns based on room type, style preferences, and custom specifications while managing credit-based access control.

Step 1: User Authentication and Credit Verification
Inputs:

- User credentials (via Clerk authentication)
- Current credit balance (queried from Neon PostgreSQL database)
- Room image file, room type (bedroom/kitchen/office), design style (modern/minimalist/rustic), custom prompt

Process:

- Verify user session and fetch credit balance from users table
- Check if credits ≥ 1 (required for one redesign generation)
- If insufficient credits, redirect to Razorpay payment page

Step 2: Image Upload and Preprocessing

- Upload original room image to Firebase Storage
- Extract image URL and metadata (room type, style, custom prompt)
- Store pending generation request in database with status: "processing"

Step 3: AI Redesign Generation

- Construct Replicate API payload with image URL, room type, design style, custom prompt, and photorealistic parameters
- Call Replicate API endpoint for image-to-image generation
- Monitor generation status via webhook/polling until completion

Step 4: Output Processing and Storage

- Download AI-generated redesigned image from Replicate
- Upload redesigned image to Firebase Storage
- Update database record:
- Set status: "completed"
- Store original_image_URL and redesigned_image_URL
- Decrement user credits by 1
- Record generation timestamp

Step 5: Dashboard Update and Notification

- Refresh user dashboard to display new redesign in history
- Update credit balance display
- Enable download/preview functionality for generated image

Illustrative Example – Bedroom Modern Redesign
User Input:

Upload: Bedroom photo Room Type: Bedroom Style: Modern

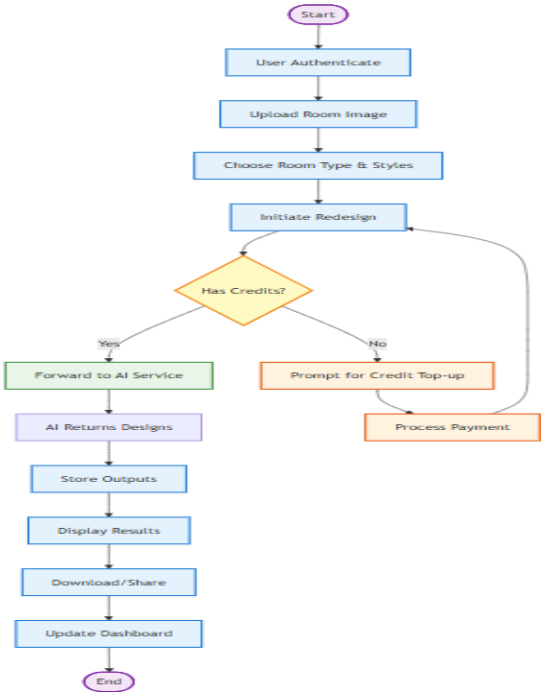
Custom Prompt: “white walls, wooden furniture, soft lighting” Generated Output:

Original: User-uploaded cluttered bedroom photo

AI Redesign: Photorealistic modern bedroom with minimalist furniture, neutral walls, wooden nightstands, ambient lighting Credit Usage: 1 credit deducted (balance: 2/3 remaining) Storage: Both images preserved in Firebase, accessible via dashboard

Scalability: Horizontal scaling via serverless Replicate API and stateless Next.js architecture

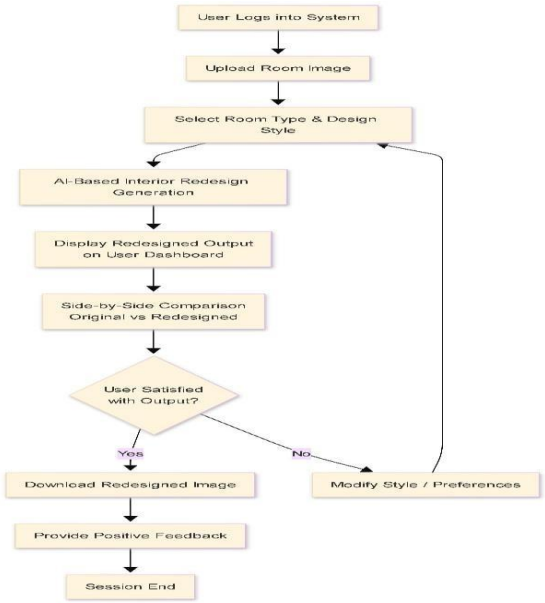
V. PROCESS FLOWCHART



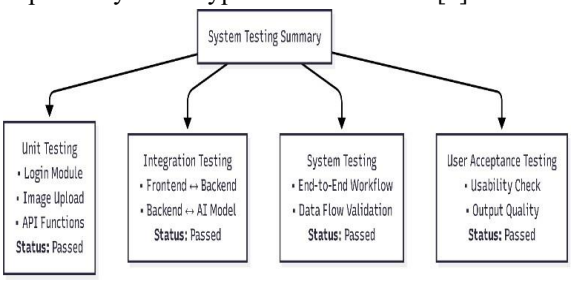
VI. RESULTS AND DISCUSSIONS

A. Validation and Testing of Systems

To confirm the functional accuracy, dependability, and integration of various system elements, the Inspira Decora system underwent comprehensive testing. In accordance with typical software testing procedures, testing was carried out at several levels, including unit, integration, system, and user acceptance testing [1]. The functioning of individual components, including user login, picture upload, backend APIs, and database operations, was confirmed by unit testing. The frontend, backend services, AI model, cloud storage, and database all communicated well thanks to integration testing.



As shown in the testing workflow diagram, the testing workflow adhered to the system process flow and architecture established during the design phase. The entire end-to-end process, from image upload to AI-based interior redesign creation and result visualisation, was confirmed by system testing. User acceptance testing verified that the system fulfilled functional and usability requirements. The fact that every test case was completed successfully shows that the suggested system meets its functional criteria and functions dependably under typical circumstances [2].



B. Performance Analysis and Outcomes of AI Interior Redesign

Real-world room photos of various interior spaces, including living rooms and bedrooms, were used to assess the AI-based interior redesign functionality. Users chose the type of room and interior design style for each test case. The diffusion-based generative AI model produced revised images that improved aesthetic components like lighting, furniture placement, and colour schemes while maintaining the original room's structural layout. Recent research has shown that diffusion models are equally successful for creating internal images [3].

Parameter	Observation
Image Upload Handling	Successful
AI Redesign Generation	Photorealistic outputs
Response Time	Few seconds per request
Output Consistency	High
System Reliability	Stable

According to performance evaluation, under typical usage settings, the system produced revised outputs in a matter of seconds per request. The backend services effectively managed cloud storage, AI inference, and image preparation. Key performance metrics like response time, output consistency, and system dependability are compiled in the performance evaluation diagram. These findings show that scalable interior redesign applications can benefit

from the chosen full-stack architecture and AI integration strategy [4].

C. User Evaluation and Discussion

The Inspira Decora platform's usability and efficacy were evaluated by users. The user interface is clear and easy to use, as demonstrated by test users' ability to upload photographs, choose preferences, and see altered outputs without technical support. The dashboard made it simple for customers to download results and compare original and revised photographs side by side. AI- assisted design systems have shown comparable gains in user experience, as documented in the literature [5].

When compared to conventional manual methods, user acceptance testing feedback revealed that visualising interior redesigns required less time and effort. The opportunity to experiment with different design styles with the same interior photograph was praised by users. Although the technique worked well for typical interior layouts, it might need to be further refined to increase accuracy in complex room configurations. Overall, the findings underscore Inspira Decora's promise for practical application by demonstrating how well it connects AI-driven design development with practical usability [6].

VII. CONCLUSION

Inspira Decora, an AI-powered interior redesigning platform that combines generative AI with a full-stack web architecture to automate and streamline interior design visualisation, was introduced in this paper. With little effort, users may upload room photos, choose their preferred designs, and get photorealistic interior redesigns using the suggested system. The platform successfully connects cutting-edge AI capabilities with practical usability by fusing diffusion-based generative models with safe authentication, cloud storage, and an easy-to-use user interface.

The system meets its functional and performance requirements, as shown by the experimental and testing results. System testing verified dependable communication across cloud infrastructure, AI services, frontend, and backend, and performance analysis demonstrated quick response times and reliable output quality. When compared to conventional manual methods, user evaluation also revealed better usability and less work when visualising interior redesigns. These findings confirm that the suggested method is feasible for actual interior redesign applications.

All things considered, Inspira Decora shows that AI-driven interior renovation may be provided via a scalable, user- focused platform without the need for expert design knowledge. Even while the existing approach works well for typical interior layouts, more improvements could make it more flexible for intricate room configurations and more customisation. The suggested approach offers a solid basis for further study and advancement in AI-assisted interior design systems.

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